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Michael Huppert
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July 11, 2008
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of	:	**Confirmation No. 6577**
Bjarne Anders HEGGSET et al.	:	Attorney Docket No. 2005_2004A
Serial No.10/562,151	:	Group Art Unit 1793
Filed April 5, 2006	:	Examiner Kuang L. Lin
METHOD AND EQUIPMENT FOR CONTINUOUS OR SEMICONTINUOUS CASTING OF METAL		**Mail Stop: Appeal Brief - Patents**

APPELLANTS' BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following is Appellant's Brief, submitted in under the provisions of 37 C.F.R. 41.37.

The fee of $510.00 required by 37 C.F.R. 41.20(b)(2) is to be charged to **Deposit Account No. 23-0975.**

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REAL PARTY IN INTEREST.

The real party in interest is NORSK HYDRO ASA, the assignee of the present invention (reel/frame 017634/0827).

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1-20 and 31 are cancelled.

Claims 21-30 are rejected. Claims 21-30 are the subject of the present appeal, and a complete copy of claims 21-30 are presented in the attached Appendix - Claims on Appeal.

STATUS OF AMENDMENTS

The following amendments were filed subsequent to the Final Rejection of October 10, 2007.

1. The amendment filed on January 10, 2008, which was not entered.

2. The amendment filed on February 11, 2008. In the Advisory Action of July 1, 2008, the Examiner indicated that, for purposes of appeal, the amendment will be entered. Thus, the claims on appeal are those presented in the amendment filed on February 11, 2008.

SUMMARY OF CLAIMED SUBJECT MATTER

The following is a discussion of the subject matter of claims 21-30. All references to the specification in this section are to the substitute specification filed on September 25, 2007.

Independent claim 21 is directed to a method for continuous or semi-continuous casting of metal. The claimed method is described on page 7, line 8 to page 8, line 11 of the specification and includes 1) providing at least one mold (3) having a mold cavity (11) that is provided with an inlet linked to a metal store (6) and an outlet having devices (15) for directly cooling the metal so that an object (25) in the form of an extended string, extrusion ingot or wire bar can be cast through the outlet; 2) supplying metal (Fig. 2; page 7, lines 10-14) to the mold from the metal store via a metal supply system (5) that is sealed (via 7) from the environment; and 3) regulating, by means of counter-pressure, the gas pressure over a metal level in the mold in relation to the metallostatic pressure in the mold, such that the metallostatic pressure at the metal solidification zone in the mold is virtually zero during casting(Fig. 3; page 7, lines 20-31).

Claim 22 recites that the metal supply system comprises a duct (31) extending between the mold (28) and an intermediate reservoir (17). As shown in Fig. 4, the duct communicates with a vacuum reservoir through a connection stub (33), and the intermediate metal reservoir is arranged at a lower level than the duct (see Fig. 4). The method further includes supplying metal to the intermediate metal reservoir via a valve device (18) such that the supplying of metal to the intermediate reservoir is regulated by the valve device in order to achieve a siphon effect through the duct (page 8, lines 29-31). The metal level in the intermediate metal reservoir is the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter pressure in the

mold during casting is equivalent to atmospheric pressure (page 9, lines 2-3).

Claim 23 further recites that the metal supply system comprises a distribution chamber (5) communicating with the mold (3) and an intermediate reservoir (17). The distribution chamber is connected to a vacuum reservoir through a connection stub (27; page 7, lines 13-14), and the intermediate metal reservoir is arranged at a lower level than the duct (should read "distribution chamber; see Fig. 2). The method is further defined as including the step of "supplying metal to the intermediate metal reservoir via a valve device (18; page 6, lines 20-21; page 7, lines 10-13). The supplying of metal to the intermediate reservoir is regulated by the valve device in order to achieve a siphon effect through the distribution chamber (page 6, line 24 to page 7, line 1). Further, the metal level in the intermediate metal reservoir is the same as or slightly higher than the metal level in the mold cavity in the mold (see Fig. 3), and the counter pressure in the mold during casting is equivalent to atmospheric pressure (page 7, line 26-31).

Claim 24 recites that the mold includes a chill that is provided with permeable wall elements for the supply of gas and/or oil to the metal solidification zone (page 6, lines 11-12).

Independent claim 25 is directed to the equipment for continuous or semi-continuous casting of metal, and the equipment includes a metal store (6), at least one mold (3) having a mold cavity (11) provided with an inlet (4) linked to the metal store and an outlet provided with devices for cooling the metal so that an object in the form of an extended string, extrusion ingot or wire bar can be cast through the outlet (page 1, lines 11-15), and a metal supply system (5) disposed between the metal store and the inlet of the mold, wherein the metal supply system is sealed from the environment (page 5, lines 28-30). The equipment also includes counter-pressure means for

regulating the gas pressure over the metal level (26; page 6, lines 24-29) in the mold in relation to the metallostatic pressure in the mold such that the metallostatic pressure in a contact point against the mold is virtually zero during casting (Fig. 3; page 8, lines 1-9).

Claim 26 depends from claim 25 and specifies that the metal supply system comprises a distribution chamber (5) having a connection stub (27) in communication with a vacuum reservoir (page 6, lines 16-19). The equipment further includes an intermediate metal reservoir (17) arranged at a lower level than the distribution chamber (see Figs. 2-4); and a valve device (18) positioned in an inlet of the intermediate metal reservoir. The supply of metal to the intermediate metal reservoir can be regulated so as to achieve a siphon effect via the distribution chamber (page 6, lines 24-27). The metal level in the intermediate metal reservoir is virtually the same as or slightly higher than the metal level in the mold cavity in the mold (see Fig. 3-4), and the counter-pressure in the mold during casting is equivalent to atmospheric pressure (page 7, lines 26-31).

Claim 27 depends from claim 25 and requires a duct (31) having a connection stub (33) in communication with a vacuum reservoir. The equipment further includes an intermediate metal reservoir (17) arranged at a lower level than the duct (see Fig. 4), and a valve device (18) positioned in an inlet of the intermediate metal reservoir. The supply of metal to the intermediate metal reservoir can be regulated so as to achieve a siphon effect via the duct, wherein the metal level in the reservoir is virtually the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter-pressure in the mold during casting is equivalent to atmospheric pressure (page 9, lines 1-3).

Claim 28 depends from claim 25 and further recites that the mold includes a chill that is of

the hot-top type and comprises permeable rings or wall elements for the supply of gas and/or oil to a metal solidification zone (page 6, lines 9-15).

Claim 29 depends from claim 26 and recites that the intermediate metal reservoir has an open top, and the distribution chamber is sealed by a lid (7; page 5, lines 28-30).

Claim 30 depends from claim 27 and recites that the intermediate metal reservoir has an open top (page 9, lines 1-3), and communicates with the duct via a vertical inlet pipe (34).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. The rejection of claims 29-30 under 35 U.S.C. 112, second paragraph.
2. The rejection of claims 21-23, 25-27 and 29-30 under 35 U.S.C. 103(a) as being unpatentable over JP 62-110,851 (hereinafter "JP '851").
3. The rejection of claims 21-30 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,071,072 to McCubbin (hereinafter"the McCubbin patent") in view of JP '851.

ARGUMENT

I. Rejection of claims 29-30 under 35 U.S.C. 112, second paragraph

In the Final Rejection, the Examiner takes the position that:

"*In clams 29 and 30, there is a lack of antecedent basis in the specification (nor in the drawings) for the claimed feature of 'intermediate metal reservoir* ***has an open top***'. " (emphasis in the original)

It appears that the Examiner is suggesting that claims 29-30 define features that are exclusive to the embodiments shown in Figs. 2 and 4. However, contrary to the Examiner's statement, both of the embodiments shown in Figs. 2 and 4 have:

i) a valve device (indicated by reference numeral 18 in both embodiments);

ii) a metal supply system that is sealed from the environment (in Fig. 2 the distribution chamber 5 is sealed from the environment by lid/cover 7; while in Fig. 4 the duct 31 of the metal supply system comprises closed gully 32); and

iii) an intermediate reservoir (17) with an open top (in Fig. 2 reference numeral 22 indicates an "open" top, this feature is shown in Fig. 1, and described on page 6, lines 4-7; in Fig. 4 the "open" top intermediate reservoir is clearly illustrated, and is described on page 8, lines 10-11 of the original specification).

Thus, a claim that recites the above features, reads on both of the disclosed embodiments, and therefore the claims do not impermissibly cross the disclosed species. Thus, the Examiner's rejection of claims 29 and 30 is incorrect because the features recited in claims 29-30 are clearly

described in the specification. The rejection of claims 29-30 under 35 U.S.C. 112, second paragraph should be reversed.

II. Rejection of claims 21-23, 25-27 and 29-30 as being unpatentable under 35 U.S.C. 103(a) in view of the teachings of JP '851

In the Final Office Action, the Examiner states that:
"*JP '851 substantially shows the invention as claimed except that it does not disclose to provide an approximate zero metallostatic pressure against the mold wall. However, it would have been obvious to those of ordinary skill in the art to obtain the optimal pressure through routine experimentation. With respect to claims 22, 26, 27, it would have been obvious to provide a valve in a dispensing system wherever it deems necessary.*"

JP '851 (hereinafter JP '851) relates to a method and device for continuous casting where a vacuum chamber 9 is provided above a holding furnace 1 to enable regulation (i.e. increase or decrease) of the metal head above the mold. However, with the solution disclosed in JP '851 it is not possible to apply a counter-pressure in the mold to control the metallostatic pressure in the solidification zone or the metal level in the mold. It is only possible to adjust the metal level in the holding furnace 1. Note that the holding furnace is located "above" the mold in JP '851.

The Examiner apparently recognizes that the JP '851 reference does not include any disclosure of a method or apparatus to control the metallostatic pressure in the mold. However, the novel features recited in the claims are simply dismissed by the Examiner based on his conclusion that such specifically claimed features would be obtained through "routine experimentation." The Examiner's conclusion is clearly not supported by facts of record or sound scientific reasoning.

Clearly, the Examiner has not met his burden of establishing a proper *prima facie* case of obviousness.

Claim 21 requires, *inter alia*, the step of "regulating, by means of counter-pressure, the gas pressure over a metal level in the mold in relation to the metallostatic pressure in the mold, such that the metallostatic pressure at the metal solidification zone in the mold is virtually zero during casting. In the present invention, the gas pressure over the metal level 26 in the mold is regulated by means of counter pressure.

JP '851 is void of any disclosure remotely related to the required method step. In fact, the metal level in the JP '851 vacuum chamber has no influence on the metallostatic pressure in the mold since the chamber is under vacuum. The pressure in the mold is determined by the metal level in the furnace 1 and the counter pressure in the mold. As shown in the drawing of JP '851 there is no way of regulating gas pressure over a metal level in the mold. Clearly, JP '851 has no counter pressure in the mold to compensate for any pressure in the furnace or the surroundings (as is the case with the present invention as defined in claim 21). Therefore, it is submitted that JP '851 lacks any structure or arrangement for holding the metallostatic pressure at zero in the solidification zone of the mold. Thus, the Examiner's contention that an optimal pressure would be obtained by routine experimentation is completely without merit because the equipment disclosed in JP '851 is incapable of controlling the metallostatic pressure in the solidification zone of the mold. Since the metallostatic pressure is not regulated, and could not be regulated in JP '851, it would not be a variable that could simply be optimized through routine experimentation.

The rejections of the claims do not include any clearly articulated reasoning from the Examiner explaining why one of ordinary skill viewing the cited references would have considered it obvious for JP '851 to regulate, by means of counter-pressure, the gas pressure over a metal level in the mold in relation to the metallostatic pressure in the mold, such that the metallostatic pressure at the metal solidification zone in the mold is virtually zero during casting. There must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *Ex parte Wada and Murphy*, at 7, BPAI Appeal No. 2007-3733 (January 14, 2008) citing *KSR int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007).

Claim 22

Claim 22 requires, *inter alia*, supplying metal to the intermediate metal reservoir via a valve device, wherein the supplying of metal to the intermediate reservoir is regulated by the valve device in order to achieve a siphon effect through the duct.

JP '851 lacks the required valve, and therefore cannot meet this limitation of claim 22. The rejection of claim 22 is premised on the Examiner's novel position that "*it would have been obvious to provide a valve in a dispensing system wherever it deems necessary.*" However, the Examiner's rejection does not take into account the differences between the claimed invention and the prior art, and does not even attempt to provide a reason why one of ordinary skill in the art would have employed a valve in JP '851 to regulate the supply of metal to the holding furnace 1. It is well settled that the "Patent and Trademark Office (PTO) must consider all claim limitations when determining patentability of an invention over the prior art." *In re Lowry*, 32 F.3d 1579, 1582; 32 USPQ2d 1031, 1034 (Fed. Cir. 1994).

In this case, the Examiner has not explained why every limitation in claim 21 would have been obvious to a person of ordinary skill in the art. Clearly, the Examiner has not established a proper *prima facie* case of obviousness with regard to the rejection of claim 22.

Claim 23

Claim 23 is similar to claim 22 but is directed to casting method employing the embodiment shown in Figs. 2-3. However, claim 23 requires a valve device positioned in an inlet of the intermediate metal reservoir, and the step of 'supplying metal to the intermediate metal reservoir via a valve device, wherein the supplying of metal to the intermediate reservoir is regulated by the valve device in order to achieve a siphon effect through the distribution chamber."

Thus, claim 23 is allowable over JP '851 for the same reasons as advanced above in connection with claim 22.

Claim 25

Independent claim 25 is directed to equipment for continuous or semi-continuous casting of metal, and requires, *inter alia*:

"counter-pressure means for regulating the gas pressure over the metal level in the mold in relation to the metallostatic pressure in the mold such that the metallostatic pressure in a contact point against the mold is virtually zero during casting."

JP '851 lacks any structure capable of regulating the gas pressure over the metal level in the mold. As explained above, the in JP '851 it is only possible to adjust the metal level in the holding

furnace which is located above the mold.

As shown in Fig. 3, the claimed invention is operable to regulate the gas pressure over the metal level 26 in the mold thereby controlling the metallostatic pressure as recited in claim 25. However, in JP '851, the only metal level that is controlled is that of the metal in holding furnace 1, and therefore the JP apparatus does not perform the function of regulating the gas pressure over the metal level in the mold as recited in claim 25. Thus, it is submitted that JP '851 clearly does not meet each and every limitation of claim 25.

Claim 26

Claim 26 recites that "the metal supply system comprises a distribution chamber having a connection stub in communication with a vacuum reservoir, the equipment further comprising:

an intermediate metal reservoir arranged at a lower level than the distribution chamber; and

a valve device positioned in an inlet of the intermediate metal reservoir, wherein the supply of metal to the intermediate metal reservoir can be regulated so as to achieve a siphon effect via the distribution chamber, wherein the metal level in the intermediate metal reservoir is virtually the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter-pressure in the mold during casting is equivalent to atmospheric pressure."

The claimed valve device is required to be in a particular location to achieve a particular effect, i.e. a siphon effect. As noted above, JP '851 does not disclose the valve device nor is the counter pressure in the mold controlled during casting to atmospheric pressure. The Examiner's summary dismissal of this limitation is improper and the rejection should be reversed.

Claim 27

Claim 27 is similar to claim 26 but is directed to the embodiment disclosed shown in Fig. 4. However, claim 27 requires a valve device positioned in an inlet of the intermediate metal reservoir. Thus, claim 27 is allowable over JP '851 for the same reasons as advanced above in connection with claim 26.

Claim 29

Claim 29 depends from claim 26 and requires that the intermediate metal reservoir has an open top and the distribution chamber is sealed by a lid. Although the Examiner does not explain how the limitations of claim 29 are met by JP '851, it would appear that the furnace 1 corresponds to the claimed intermediate chamber, and that the vacuum chamber 9 corresponds to the claimed distribution chamber. However, the intermediate reservoir 1 of the JP '851 device is closed, and there is no lid in the vacuum chamber 9. Therefore, JP '851 does not meet each and every limitation of claim 29, and thus claim 29 is patentable over JP '851.

Claim 30

Claim 30 depends from claim 27 and requires that the intermediate metal reservoir has an open top, and communicates with the duct via a vertical inlet pipe. Although the Examiner does not explain how the limitations of claim 30 are met by JP '851, it would appear that the furnace 1 corresponds to the claimed intermediate chamber, and that the vacuum chamber 9 corresponds to the

claimed duct. However, the furnace of JP '851 does not have an open top. Therefore, JP '851 does not meet each and every limitation of claim 30, and thus claim 30 is patentable over the JP '851 disclosure.

III. Rejection of claims 21-30 as being unpatentable under 35 U.S.C. 103(a) over the McCubbin patent in view of JP '851

In the Final Office Action, the Examiner states that:

"*McCubbin substantially shows the invention as claimed except that he does not show to regulate the molten metal such that the metallostatic pressure against the mold wall is approximate zero. However, JP '851 disclose to provide a vacuum chamber to a molten metal supply path to a continuous casting mold and evacuating the inside of the chamber to suck the molten metal such that the metallostatic pressure against the mold wall is decreased. The process of JP '851 has an advantage of speeding up the casting process as well as improving the ingot quality. It would have been obvious to provide the molten metal dispensing system of JP '851 in the apparatus of McCubbin in view of the advantage. It would have been obvious to those of ordinary skill in the art to obtain the optimal pressure through routine experimentation. With respect to claims 24 and 28, it is conventional to provide permeable rings in the DC mold for supplying lubricant. With respect to claims, 22, 26, 27, it would have been obvious to provide a valve in a dispensing system wherever it deems necessary.*"

It is submitted that the present invention, as defined in claims 21-31, is allowable over the McCubbin patent and JP '851 combination, as proposed by the Examiner, for the following reasons.

The **McCubbin** reference is applied by the Examiner in a rejection of claims 21-30 in combination with JP '851. McCubbin shows, in Fig. 1, a mold 1 having a water chamber 2 for chilling the wall 3 and a water slit 4 for emitting water directly onto the ingot 5. The McCubbin process includes employing a chilled mold section having a selected vertical extent, maintaining a selected casting rate, and maintaining, in the hot top section, a head of molten metal within a

range of head values. However, as acknowledged by the Examiner, McCubbin lacks any disclosure of regulating, by means of counter-pressure, the gas pressure over a metal level in the mold in relation to the metallostatic pressure in the mold, such that the metallostatic pressure at the metal solidification zone in the mold is virtually zero during casting. Accordingly, the Examiner relies on JP '851 to teach a vacuum chamber that decreases the metallostatic pressure against the mold wall. Of course, as described above, JP '851 has no means to hold the metallostatic pressure at zero in the solidification zone of the mold. Therefore, any combination of the McCubbin and JP '851 references would not result in Appellant's invention as defined in independent claims 21 and 25.

The result of the Examiner's proposed combination is that the casting system of JP '851 is modified by substituting the mold disclosed in the McCubbin patent. It is unclear how the level-pour, hot top 6 could be employed in the JP '851 system, however, the resulting combination would obviously suffer from the same deficiencies discussed above in connection with the rejection based on JP '851 taken alone. Therefore, at least claims 21-23, 25-27 and 29-30 are allowable over the teachings of the McCubbin patent and JP '851 for the same reasons advanced above.

CONCLUSION

In view of the above, it is submitted that the rejection of claims 29 and 30 under 35 U.S.C. 112, second should be reversed. Also, in view of the fact that JP '851 taken alone or in combination with the McCubbin patent does not disclose or suggest each and every limitation of the rejected claims, it is submitted that the rejections of claims 20-30 must be reversed.

Respectfully submitted,

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APPENDIX - Claims on Appeal

21. A method for continuous or semi-continuous casting of metal, the method comprising:

providing at least one mold having a mold cavity that is provided with an inlet linked to a metal store and an outlet having devices for directly cooling the metal so that an object in the form of an extended string, extrusion ingot or wire bar can be cast through the outlet;

supplying metal to the mold from the metal store via a metal supply system that is sealed from the environment; and

regulating, by means of counter-pressure, the gas pressure over a metal level in the mold in relation to the metallostatic pressure in the mold, such that the metallostatic pressure at the metal solidification zone in the mold is virtually zero during casting.

22. A method in accordance with claim 21, wherein the metal supply system comprises a duct extending between the mold and an intermediate reservoir, the duct communicates with a vacuum reservoir through a connection stub, and the intermediate metal reservoir is arranged at a lower level than the duct, the method further comprising:

supplying metal to the intermediate metal reservoir via a valve device, wherein the supplying of metal to the intermediate reservoir is regulated by the valve device in order to achieve a siphon effect through the duct,

wherein the metal level in the intermediate metal reservoir is the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter pressure in the mold during casting is equivalent to atmospheric pressure.

23. A method in accordance with claim 21, wherein the metal supply system comprises a distribution chamber communicating with the mold and an intermediate reservoir, the distribution chamber is connected to a vacuum reservoir through a connection stub, and the intermediate metal reservoir is arranged at a lower level than the duct, the method further comprising:

supplying metal to the intermediate metal reservoir via a valve device, wherein the supplying of metal to the intermediate reservoir is regulated by the valve device in order to achieve a siphon effect through the distribution chamber,

wherein the metal level in the intermediate metal reservoir is the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter pressure in the mold during casting is equivalent to atmospheric pressure.

24. A method in accordance with claim 21, wherein the mold includes a chill that is provided with permeable wall elements for the supply of gas and/or oil to the metal solidification zone.

25. Equipment for continuous or semi-continuous casting of metal, the equipment comprising:

a metal store;

at least one mold having a mold cavity provided with an inlet linked to the metal store and an outlet provided with devices for cooling the metal so that an object in the form of an extended string, extrusion ingot or wire bar can be cast through the outlet,

a metal supply system disposed between the metal store and the inlet of the mold, wherein the metal supply system is sealed from the environment; and

counter-pressure means for regulating the gas pressure over the metal level in the mold in relation to the metallostatic pressure in the mold such that the metallostatic pressure in a contact point against the mold is virtually zero during casting.

26. The equipment as claimed in claim 25, wherein the metal supply system comprises a distribution chamber having a connection stub in communication with a vacuum reservoir, the equipment further comprising:

an intermediate metal reservoir arranged at a lower level than the distribution chamber; and

a valve device positioned in an inlet of the intermediate metal reservoir, wherein the supply of metal to the intermediate metal reservoir can be regulated so as to achieve a siphon effect via the distribution chamber, wherein the metal level in the intermediate metal reservoir is virtually the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter-pressure in the mold during casting is equivalent to atmospheric pressure.

27. The equipment as claimed in claim 25, wherein the metal supply system comprises a duct having a connection stub in communication with a vacuum reservoir, the equipment further comprising:

an intermediate metal reservoir arranged at a lower level than the duct; and

a valve device positioned in an inlet of the intermediate metal reservoir, wherein the supply

of metal to the intermediate metal reservoir can be regulated so as to achieve a siphon effect via the duct, wherein the metal level in the reservoir is virtually the same as or slightly higher than the metal level in the mold cavity in the mold, and the counter-pressure in mold during casting is equivalent to atmospheric pressure.

28. The equipment as claimed in claim 25, wherein the mold includes a chill that is of the hot-top type and comprises permeable rings or wall elements for the supply of gas and/or oil to a metal solidification zone.

29. The equipment as claimed in claim 26, wherein the intermediate metal reservoir has an open top, and the distribution chamber is sealed by a lid.

30. The equipment as claimed in claim 27, wherein the intermediate metal reservoir has an open top, and communicates with the duct via a vertical inlet pipe.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None